Chapter-I

INTRODUCTION:

Reactive dyes are coloured compounds which contain one or two groups capable of forming covalent bonds between a carbon or phosphorus atom of the dye ion or molecule and an oxygen, nitrogen or sulphur atom of a hydroxy, an amino or a mercapto group, respectively, of the substrate. Such covalent bonds are formed with the amino, hydroxyl groups of cellulosic fibres, with the amino, hydroxyl and mercapto groups of protein fibres and with the amino groups of polyamides [1]. Reactive dyes were initially introduced commercially for application to cellulose fibres and this is still their most important use. The first commercial reactive dyes for cellulose were synthesized by Rattee and Stephen and marketed by ICI in 1956 under the trade name Procion M [2,3]. Two reactive groups give higher fixation yield than monoazo dyes which possess one reactive group because if one of the two dye fibre bond is hydrolyzed, another is still left for fixation [4,5]. Additionally, most of the reactive dyes used in exhaust dyeing employ at least two reactive groups in order to maximize fixation [6]. The reactive group may be attached to almost any coloured molecular system and can be used to produce very bright and very dull shades of all colours [7]. These dyes are used on higher value clothes which are normally mercerized [8]. Reactive dyes are widely used for dyeing and printing protein fibres. The hydrophilic group of conventional reactive dyes is an anionic group, e.g. sulphonate or carboxylate but the hydrophilic group of reactive cationic dyes is cationic [9]. Hot brand reactive dyes are of major commercial importance in reactive dyeing [10]. Patel et al. [11] have synthesized hot brand bisazo reactive dyes. These dyes were applied on silk, wool and cotton fibres. Reactive dyes are the only textile colouration products designed to furnish covalent bonds between dye and substrate during dyeing. Although many different reactions can be used for fixation, two main types are exploited commercially, i.e.

hetero aromatic nucleophilic substitution and addition to an activated alkane [12-14]. Pingzhong Chu [15] synthesized reactive brown dye gave good light fastness, perspiration resistance and soaping resistance. They can be applied to dip dyeing, pad dyeing, jig dyeing and continuous pad dyeing of cotton, rayon and hemp textiles. Patel et al. [16] have also synthesised some new reactive dyes based on quinazoline. Their dyeing performance as reactive dyes has been assessed on silk, wool and cotton fibres. The dyed fibre showed fair to very good light fastness and very good to excellent fastness to washing and rubbing. Reactive dyes are well known and applied for dyeing of different materials [17]. Patel et al. [18] have also synthesised monoazo reactive dyes based on 4,4'-methylene bis-(2-nitro aniline).

Chapter-II

EXPERIMENTAL:

Experimental work includes synthesis of various heterocyclic reactive dyes. This Chapter comprises eight series.

Series-1: Monoazo reactive dyes based on 3-(4-(4-amino-3-nitrobenzyl)-2-nitrophenyl)-2-phenylquinazolin-4(3H)-one:

These monoazo reactive dyes have been synthesized by diazotized 3-(4-(4-amino-3-nitrobenzyl)-2-nitrophenyl)-2-phenylquinazolin-4(3H)-one and coupling with various 2-(4-aminophenylsulphonyl) ethyl hydrogen sulfato cyanurated coupling components such as H-acid, Gamma acid, J-acid, N-Methyl J-acid, N-Phenyl J-acid, S-acid, Naphthionic acid, Peri acid, Bronner acid, Tobias acid, K-acid and Koch acid.

Series-2: Monoazo reactive dyes based on 3-(4-(4-amino-3-nitrobenzyl)-2-nitrophenyl)-2-phenylquinazolin-4(3H)-one:

These monoazo reactive dyes have been synthesized by diazotized 3-(4-(4-amino-3-nitrobenzyl)-2-nitrophenyl)-2-phenylquinazolin-4(3H)-one and coupling with various o-anisidino cyanurated coupling components such as H-acid, Gamma acid, J-acid, N-Methyl J-acid, N-Phenyl J-acid, S-acid, Naphthionic acid, Peri acid, Bronner acid, Tobias acid, K-acid and Koch acid.

Series-3: Monoazo reactive dyes based on 3-(4-(4-amino-2-nitrobenzyl)-3-nitrophenyl)-2-phenylquinazolin-4(3H)-one:

These monoazo reactive dyes have been synthesized by diazotized 3-(4-(4-amino-2-nitrobenzyl)-3-nitrophenyl)-2-phenylquinazolin-4(3H)-one and coupling with various 2-(4-aminophenylsulphonyl) ethyl hydrogen sulfato cyanurated coupling components such as H-acid, Gamma acid, J-acid, N-Methyl J-acid, N-Phenyl J-acid, S-acid, Naphthionic acid, Peri acid, Bronner acid, Tobias acid, K-acid and Koch acid.

Series-4: Monoazo reactive dyes based on 3-(4-(4-amino-2-nitrobenzyl)-3-nitrophenyl)-2-phenylquinazolin-4(3H)-one:

These monoazo reactive dyes have been synthesized by diazotized 3-(4-(4-amino-2-nitrobenzyl)-3-nitrophenyl)-2-phenylquinazolin-4(3H)-one and coupling with various o-anisidino cyanurated coupling components such as H-acid, Gamma acid, J-acid, N-Methyl J-acid, N-Phenyl J-acid, S-acid, Naphthionic acid, Peri acid, Bronner acid, Tobias acid, K-acid and Koch acid.

Series-5: Monoazo reactive dyes based on 3-(4-(4-amino-2,5-dichlorobenzyl)-2,5-dichlorophenyl)-2-phenylquinazolin-4(3H)-one:

These monoazo reactive dyes have been synthesized by diazotized 3-(4-(4-amino-2,5-dichlorobenzyl)-2,5-dichlorophenyl)-2-phenylquinazolin-4(3H)-one and coupling with various 2-(4-aminophenylsulphonyl) ethyl hydrogen sulfato cyanurated coupling components such as H-acid, Gamma acid, J-acid, N-Methyl J-acid, N-Phenyl J-acid, S-acid, Naphthionic acid, Peri acid, Bronner acid, Tobias acid, K-acid and Koch acid.

Series-6: Monoazo reactive dyes based on 3-(4-(4-amino-2,5-dichlorobenzyl)-2,5-dichlorophenyl)-2-phenylquinazolin-4(3H)-one:

These monoazo reactive dyes have been synthesized by diazotized 3-(4-(4-amino-2,5-dichlorobenzyl)-2,5-dichlorophenyl)-2-phenylquinazolin-4(3H)-one and coupling with various o-anisidino cyanurated coupling components such as H-acid, Gamma acid, J-acid, N-Methyl J-acid, N-Phenyl J-acid, S-acid, Naphthionic acid, Peri acid, Bronner acid, Tobias acid, K-acid and Koch acid.

Series-7: Monoazo reactive dyes based on 2-amino-5-(3-carboxy-4-(4-oxo-2-phenylquinazolin-3(4H)-yl) benzyl) benzoic acid:

These monoazo reactive dyes have been synthesized by coupling diazotized 2-amino-5-(3-carboxy-4-(4-oxo-2-phenylquinazolin-3(4H)-yl) benzyl) benzoic acid with various 2-(4-aminophenylsulphonyl) ethyl hydrogen sulphato cyanurated coupling components such as H-acid, Gamma acid, J-acid, N-Methyl J-acid, N-Phenyl J-acid, S-acid, Naphthionic acid, Peri acid, Bronner acid, Tobias acid, K-acid and Koch acid.

Series-8: Monoazo reactive dyes based on 2-amino-5-(3-carboxy-4-(4-oxo-2-phenylquinazolin-3(4H)-yl) benzyl) benzoic acid:

These monoazo reactive dyes have been synthesized by coupling diazotized 2-amino-5-(3-carboxy-4-(4-oxo-2-phenylquinazolin-3(4H)-yl) benzyl) benzoic acid with various o-anisidino cyanurated coupling components such as H-acid, Gamma acid, J-acid, N-Methyl J-acid, N-Phenyl J-acid, S-acid, Naphthionic acid, Peri acid, Bronner acid, Tobias acid, K-acid and Koch acid.

Chapter-III

CHARACTERISATION:

All the dyes samples are characterised by Thin Layer Chromatography, Elemental Analysis, UV Spectra, Infrared Spectra and Proton Magnetic Resonance Spectra of some selected synthesized dyes.

Chapter-IV

APPLICATION:

These dyes were applied to silk, wool and cotton fabric with 2% shade and their dyeing performance on each fabric was evaluated.

REFERENCES:

1. Zollinger H., Color Chemistry, 2nd Ed., Weinheim: VCH (1991).
2. Bredereck K., Schumacher C., Dyes and Pigments, 21(1), 23-43 (1993).
3. Matsi M., Ulrich M., Zollinger H., J. Soc. Dyers Color. 104, 425-431 (1988).
4. Rattee I.D and Stephen W.E., Journal of the Society of Dyers and Colourists, 76(1), 6 (1960).

5. Lewis D.M., Renfrew A.H.M and Siddique A. A., Dyes and Pigments, 47(1-2), 151-16(2000).
6. Taylor, J.A., Recent developments in reactive dyes. Rev. Prog. Color. 30, 93-107 (2000).
7. Ciba Geigy USP 5 552 532 (1996).
8. Shah K. M, Handbook of Synthetic Dyes and Pigments, Multi-Tech Publishing Co., Vol. I, 229 (1998).
9. Kongliang X., Aiquin H., J. Soc. Dyers Colors, 114 20 (1998).
10. Stead C.V., Dyes and Pigments, 3, 61(1982).
11. Patel D. R., Patel J. A., Patel K. C., J. Saudi Chem. Soc., 13 279 (2009).
12. Stead C. V., Dyes and Pigments, 3, 61 (1982).
13. Brunnschweiler E and Siegrist G., Textilveredlung, 19, 305 (1984).
14. Rattee I.D., Rev. Prog. Coloration, 14, 50 (1984).
15. Pingzhong Chu, Faming Zhuanli Shenging Gongkai Shuomingshu CN 101, 081, 937 (2007).
16. Patel Divyesh R., Bilimoriya Jignesh T and Patel K.C., International Journal of Pure and Applied Chemistry,Vol. 6 ,No. 1, 53-58(2011).
17. Warnig D, Hallas G, editors, the chemistry and application of dyes, London: Plenum, (1990).
18. Patel Pratixa K., Patel Sandip K., Patel Paresh S., Patel Keshav C ,International Journal of Science and Research. Volume 3 Issue 12, December 2269-2274 (2014).

RESEARCH SCHOLAR **SUPERVISING TEACHER**

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